

WHAT IS CLAIMED IS:

5

1. An image reader apparatus for lighting a manuscript surface of a manuscript, which is set on a manuscript stand, in a line state by a light source part, and for image-forming a reflection light from a reading part of the manuscript surface lighted in the line state, to an image sensor, by an image forming lens which forms a part of a scaled down optical system so that an image of the manuscript is read, comprising:

15 an irradiation opening part for irradiating a lighting light to an outside part, which is formed at the light source; and

an optical element for attenuating a light amount so as to be permeated, which is provided  
20 between the irradiation opening part and the manuscript stand.

25

2. An image reader apparatus for lighting a manuscript surface of a manuscript, which is set on a manuscript stand, in a line state by a cylinder shaped lamp, and for image-forming a reflection light from a reading part of the manuscript surface lighted in the line state, to an image sensor, by an image forming lens which forms a part of a scaled down optical system so that an image of the manuscript is read, comprising:

10            an irradiation opening part for irradiating a lighting light to an outside part, which is formed at the cylinder shaped lamp and extends in a direction which the lamp extends; and

             an optical element for attenuating a light amount so as to be permeated, which is provided between the irradiation opening part and the manuscript stand.

20

3. The image reader apparatus as claimed in claim 2,

             wherein the cylinder shaped lamp is an Xenon lamp, and

25

the optical element is provided at the irradiation opening part.

5

4. The image reader apparatus as claimed in claim 2,

wherein the cylinder shaped lamp is moved in  
10 a sub scanning direction perpendicular to a main  
scanning direction in which the cylinder shaped lamp  
extends, so that the manuscript surface of the  
manuscript is read.

15

5. The image reader apparatus as claimed in claim 2,

20 wherein the optical element is formed by an  
ND filter having a surface to which a light absorbing  
process is applied.

25

6. The image reader apparatus as claimed in  
claim 2,

wherein the optical element is formed by an  
ND filter having a surface to which a black net point  
5 process is applied.

10 7. The image reader apparatus as claimed in  
claim 2,

wherein a permeability rate of the optical  
element is set corresponding to an emission light  
strength distribution in a direction which the  
15 cylinder shaped lamp extends, so that the  
permeability rate is set small at a position where  
the emission light strength distribution is high, and  
the permeability rate is set large at a position  
where the emission light strength distribution is low.

20

8. The image reader apparatus as claimed in  
25 claim 2,

wherein a reflector is provided so as to face the irradiation opening part of the cylinder shaped lamp, so that a lighting light from the cylinder shaped lamp is reflected and is led from a direction facing a direct lighting light that is directly led from the cylinder shaped lamp to the reading part, to the reading part,

the optical element has a permeable area where the direct lighting light which is directly led from the cylinder shaped lamp to the reading part is permeated, and a permeable area where the lighting light which is led to the reflector is permeated, and

a permeability rate of the permeable area where the lighting light which is led to the reflector is permeated is larger than a permeability rate of the permeable area where the direct lighting light is permeated.

20

9. The image reader apparatus as claimed in claim 2,

wherein a reflector is provided so as to face the irradiation opening part of the cylinder

25

shaped lamp, so that a lighting light from the  
cylinder shaped lamp is reflected and is led from a  
direction facing a direct lighting light, which  
direct lighting light is directly led from the  
5 cylinder shaped lamp to the reading part, to the  
reading part,

the optical element has a permeable area  
where the direct lighting light which is directly led  
from the cylinder shaped lamp to the reading part is  
10 permeated, and a permeable area where the lighting  
light which is led to the reflector is permeated, and

a permeability rate of the permeable area  
where the lighting light which is led to the  
reflector is progressively larger, from the permeable  
15 area where the direct lighting light which is  
directly led from the cylinder shaped lamp to the  
reading part is permeated, to the permeated area  
where the lighting light which is led to the  
reflector is permeated.

20

10. The image reader apparatus as claimed in  
25 claim 2,

wherein the optical element shows a color having a supplemental relationship with an emission color of the cylinder shaped lamp.

5

11. The image reader apparatus as claimed in claim 2,

10                wherein the optical element cuts a lighting light in an infrared wave length area.

15

12. The image reader apparatus as claimed in claim 2,

                wherein the optical element is formed by a polarization filter.

20

13. The image reader apparatus as claimed in  
25    claim 2,

wherein the optical element is provided so as to be tilted against a segment perpendicularly connecting a center axis of the cylinder shaped lamp and the reading part.

5

14. The image reader apparatus as claimed in  
10 claim 2,

wherein a revolving mechanism for rotating the optical element in a state where a rotational shaft situated in parallel to a direction in which the cylinder shape extends is a center of rotation,  
15 so that the optical element can be fixed.

20 15. The image reader apparatus as claimed in claim 2,

wherein the optical element is provided so as to be separated from the cylinder shaped lamp, and has a surface facing the cylinder shaped lamp that is



a curved surface which curves along an external form of the cylinder shaped lamp.

5

16. An image reader apparatus for lighting a manuscript surface of a manuscript which is set on a manuscript stand, in a line state by a cylinder  
10 shaped lamp, and for image-forming a reflection light from a reading part of the manuscript surface lighted in the line state, to an image sensor, by an image forming lens which forms a part of a scaled down optical system so that an image of the manuscript is  
15 read, comprising:

an irradiation opening part for irradiating a lighting light to an outside part, which is formed at the cylinder shaped lamp and extends in a direction which the lamp extends; and

20 an attenuation film, provided at the irradiation opening part, for attenuating a reflection light which is reflected from the reading part of the manuscript surface, is incident on an inside part of the cylinder shaped lamp through the  
25 irradiation opening part, and is reflected at an

inside part wall surface of the cylinder shaped lamp  
so as to be led to the reading part through the  
irradiation opening part.

5

17. A cylinder shaped lamp, comprising:  
a tube wall;

10 an irradiation opening part, formed at a  
part of the tube wall, for lighting a reading part of  
a manuscript surface of a manuscript, which is set on  
a manuscript stand, in a line state; and

an attenuation film, provided at the  
15 irradiation opening part, for attenuating a  
reflection light which is reflected from the reading  
part of the manuscript surface, is incident on an  
inside part of the cylinder shaped lamp through the  
irradiation opening part, and is reflected at an  
20 inside part wall surface of the cylinder shaped lamp  
so as to be led to the reading part through the  
irradiation opening part.

25

18. A cylinder shaped lamp, comprising:  
a tube wall covered with a protection tube;  
a irradiation opening part, formed at the  
tube wall, for lighting a reading part of a  
5 manuscript surface of a manuscript, which is set on a  
manuscript stand, in a line state; and  
an optical element, put between the tube  
wall and the protection tube by the protection tube  
so as to be fixed, for attenuating a reflection light  
10 which is reflected from the reading part of the  
manuscript surface, is incident on an inside part of  
the cylinder shaped lamp through the irradiation  
opening part, and is reflected at an inside part wall  
surface of the cylinder shaped lamp so as to be led  
15 to the reading part through the irradiation opening  
part.

20

19. A cylinder shaped lamp, comprising:  
a tube wall covered with a protection tube;  
an irradiation opening part, formed at the  
tube wall, for lighting a reading part of a

manuscript surface of a manuscript, which is set on a manuscript stand, in a line state; wherein

the protection tube functions as an optical element for attenuating a reflection light which is  
5 reflected from the reading part of the manuscript surface, is incident on an inside part of the cylinder shaped lamp through the irradiation opening part, and is reflected at an inside part wall surface of the cylinder shape so as to be led to the reading  
10 part through the irradiation opening part.

15 20. An image reader apparatus for lighting a manuscript surface of a manuscript, in a line state by a cylinder shaped lamp, and for image-forming a reflection light from a reading part of the manuscript surface lighted in the line state, to an  
20 image sensor, by an image forming lens which forms a part of a scale down optical system so that an image of the manuscript is read, comprising:

an optical element having a whole permeable area and a semi-permeable area,

wherein the whole permeable area faces the reading part from an optical axis direction of the image forming optical system, and

the semi-permeable area is located between  
5 the manuscript surface and the cylinder shaped lamp,  
and

the lighting light formed by the cylinder shaped lamp is attenuated so as to be permeated at the manuscript surface in the semi-permeable area.  
10

21. The image reader apparatus as claimed in  
15 claim 20,

wherein the semi-permeable surface has a plurality of regular net points having constant sizes.

20

22. The image reader apparatus as claimed in claim 20,

wherein the optical element is a contact glass located between the image sensor and the manuscript, and

the semi-permeable area is formed by  
5 applying a semi-permeable process to the contact glass.

10

23. The image reader apparatus as claimed in claim 20,

wherein the optical element is adjustable in a direction parallel to the manuscript surface.

15

24. The image reader apparatus as claimed in  
20 claim 22,

wherein the semi-permeable area of the contact glass is formed at a surface of a side facing the image sensor.

25

25. The image reader apparatus as claimed in  
claim 20, further comprising a reflector receiving a  
part of the lighting light from the cylinder shaped  
lamp and reflecting the light to the manuscript so  
5 that the manuscript surface is lighted,

wherein a first semi-permeable area is  
provided at a side of the cylinder shaped lamp side  
of the optical element and a second semi-permeable  
area is provided at a side of the reflector via the  
10 whole permeable area, and

a permeability rate of the second semi-  
permeable area at the reflector side is higher than a  
permeability rate of the first semi-permeable area at  
the cylinder shaped lamp side.

15

26. The image reader apparatus as claimed in  
20 claim 20,

wherein a permeability rate of the semi-  
permeable area of the optical element is set  
corresponding to an emission light strength  
distribution in a direction which the cylinder shaped  
25 lamp extends, so that the permeability rate is set

small at a position where the emission light strength distribution is high, and the permeability rate is set large at a position where the emission light strength distribution is low:

5

27. The image reader apparatus as claimed in  
10 claim 20,

wherein a color of the optical element has a supplemental relationship with an emission light color of the cylinder shaped lamp.

15

28. The image reader apparatus as claimed in  
claim 24,

20 wherein the contact glass has a non-permeable film formed at an area other than the reading area common to the image sensor at a surface of a side facing the manuscript surface.

25



29. The image reader apparatus as claimed in claim 28,

wherein the permeability rate at the permeable area of the optical element is smaller as being far from the reading part in a state where the reading part is a center part.

10

30. An image reader apparatus for lighting a manuscript surface of a manuscript, in a line state by a cylinder shaped lamp, and for image-forming a reflection light from a reading part of the manuscript surface lighted in the line state, to an image sensor, by a image forming lens which forms a part of a scaled down optical system so that an image of the manuscript is read, comprising:

an optical element having a diffusion reflection surface by which a reflection light reflected from the manuscript surface is diffusion reflected to the manuscript surface, provided at a position where a lighting light leading from the cylinder shaped lamp to the manuscript surface is not blocked and an optical path of the image forming

optical system is not blocked, so as to be separated from the manuscript surface.

5

31. An image reader apparatus for lighting a manuscript surface of a manuscript, in a line state by a cylinder shaped lamp, and for image-forming a reflection light from a reading part of the manuscript surface lighted in the line state, to an image sensor, by a image forming lens which forms a part of a scaled down optical system so that an image of the manuscript is read, comprising:

15           an optical element having a diffusion reflection surface by which a lighting light injected from the cylinder shaped lamp is diffusion-reflected in a direction far from the manuscript surface, provided at a position where the lighting light  
20   leading from the cylinder shaped lamp to the manuscript surface is not blocked and at a position of an opposite side to a surface facing the manuscript surface of the contact glass.

25

32. The image reader apparatus as claimed in  
claim 30, further comprising a mountain part and a  
valley part which have a triangle cross section and  
extend in a main scanning direction which the  
5 cylinder shaped lamp extends,

wherein a plurality of the mount parts and  
the valley parts are provided alternatively in a sub  
scanning direction perpendicular to the main scanning  
direction.

10

33. The image reader apparatus as claimed in  
15 claim 32, wherein a pitch from one mountain part to  
an adjacent mountain part or a pitch from one valley  
part to an adjacent valley part is equal to or larger  
than two times as large as an image reading  
resolution.

20

34. The image reader apparatus as claimed in  
25 claim 30,

wherein at least two optical elements are provided so that the optical path of the image forming optical system is put between the optical elements and there is an interval in a direction perpendicular to a direction which the cylinder shaped lamp extends.

10

35. An image reader apparatus for lighting a manuscript surface of a manuscript, in a line state by a cylinder shaped lamp, and for image-forming a reflection light from a reading part of the manuscript surface lighted in the line state, to an image sensor, by an image forming lens which forms a part of a scale down optical system so that an image of the manuscript is read, comprising:

an optical element having a diffusion-reflection surface by which a reflection light reflected from the manuscript surface is diffusion reflected to the manuscript surface, provided at a position where the lighting light leading from the cylinder shaped lamp to the manuscript surface is not blocked and an optical path of the image forming

optical system is not blocked, so as to be separated from the manuscript surface; and

an optical element having a diffusion reflection surface by which a lighting light injected from the cylinder shaped lamp is diffusion-reflected in a direction far from the manuscript surface, provided at a position where the lighting light leading from the cylinder shaped lamp to the manuscript surface is not blocked and at a position of an opposite side to a surface facing the manuscript surface of the contact glass.

15

36. The image reader apparatus as claimed in claim 30,

wherein a wider area than the reading part is lighted by the lighting light.

20

37. The image reader apparatus as claimed in claim 30,

25

wherein the diffusion reflected surface of the optical element has a supplemental relationship with a color at the peripheral part of the lighting optical system.

5

38. The image reader apparatus as claimed in  
10 claim 33,

wherein, corresponding to a light amount distribution of the lighting light in a main scanning direction, a reflection ratio is set lower as light strength is higher and the reflection ratio is set  
15 higher as the light strength is lower.

20 39. The image reader apparatus as claimed in claim 30,

wherein the diffusion reflection surface is a curved surface in a state where a curvature center is situated at a side of the manuscript surface.

25